National Association of Forest Industries

Timber Manual
Datafile SS4

Timber Decks

Commercial, Industrial and Marine

Revised Edition
2004

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Cover Photo: Hardwood decking (120 x 45) set in concrete surrounds, screw fixed from underside, with panels located with stainless steel bolts.

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The information, opinions, advice and recommendations contained in this Datafile have been prepared with due care. They are offered only for the purpose of providing useful information to assist those interested in technical matters associated with the specification and use of timber and timber products. While every effort has been made to ensure that this Datafile is in accordance with current technology, it is not intended as an exhaustive statement of all relevant data, and as successful design and construction depends upon numerous factors outside the scope of the Datafile, the National Association of Forest Industries Ltd accepts no responsibility for errors or omissions from this Datafile, nor for specification or work done or omitted to be done in reliance on this Datafile.

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Introduction

The natural appeal and strength of timber continues to make it the ideal choice for decking in commercial, industrial and marine structures, including:

- marinas
- wharves
- bridges
- foot bridges
- loading docks
- commercial/industrial decks and walkways
- grandstands, and
- tourist projects

Such applications are demanding on building materials, but the following advantages of timber continue to satisfy both design and construction needs, as they have done for more than two hundred years in Australia. This is due to timber being:

- workable
- cost competitive
- high in strength to weight ratio
- readily available
- rust and corrosion free
- impact absorbing (shock loads)
- durable, and
- easily repaired and replaced

Scope

This Datafile contains design specifications for the construction of timber decks in fully exposed environments, including marine areas. It looks at applications where point loads are more than 1.8 kN and uniformly distributed loads are about 4.0 kPa.

For domestic and light decking applications, refer to the Standards Australia AS1684 *Timber Framing Code,* or the various framing manuals published by the your State Timber industry Associations (see page 14).

For flooring applications protected from the weather, refer to *Datafile SS3 - Timber Floors – Commercial and Industrial*. The details provided in this Datafile are suitable to square edged (may be rounded or arrised but not tongue and grooved) timber decking that are spaced and joined over joists. (Details on supporting and foundation structures are not included.)

Timber jetty provides access to deep water

Suspended walkway in mangrove sanctuary.

Standards, Grades and Quality Assurance

Table 1 provides information on the relevant Australian Standards, quality assurance programmes and grading available for timber deck framing and decking boards. Recognised quality assurance programmes may not be available for some products or species, but third party certification of grading and compliance with Australian Standards can be provided by the Timber Industry Association in your state (see list on page 14.)

Sizes and Profiles

Decking is available in unseasoned and seasoned timber from a wide range of species, in various grades and sizes. Table 2 provides some general information about decking board sizes and availability. To obtain more specific details about the availability of different sizes, species, grades and quantities, it is strongly recommended to contact your local supplier.

Surface Texture

Unseasoned timber with a sawn upper face provides greater long-term weathering capacity than a fully dressed surface. Decking should only be sized on two edges and one face (underside) if a sawn face is required. Some seasoned decking is available with a reeded or striated top surface.

Arris and Corners

For square-dressed or sized decking, a 3mm arris should be specified for the top corners. Profiles are also available in seasoned decking with rounded corners. Such treatment of arrises or corners will lessen the incidence of splintering and improve the performance of the coatings applied to the decking timbers. Refer to Figure 1 for typical profiles.

Width to thickness Ratio

To lessen cupping and moisture movements in decking, the width to thickness ratio of decking should not exceed about 3:1.

Table 1: Timber decking standards, grades and quality assurance programs

Species	Australian Standard	Grades	Quality Assurance Programme	Availability (States)
Decking Framing - Bearers, Joists, Girders, etc.				
Hardwood - Unseasoned	AS2082	F8 to F17	AHQC	All States (except WA)
			FPA (WA)	WA
Hardwood - Seasoned	AS2082	F14 to F27	AHQC	All States (except WA)
			FPA (WA)	WA
Softwood - Seasoned	AS2858, AS1748-1749	F5, F8, F11	Pine Div QTB	Qld and NSW
Radiata pine - Seasoned	AS2858, AS1748-1749	F5, F8, F11	RPAA	All States
Cypress - Unseasoned	AS2858	F4, F5	Cypress Div QTB	QLD, NSW and Vic
Decking Boards				
Hardwood - Unseasoned	AS2082	Structural No.2	AHQC	All States (except WA)
		Standards Grade	FPA (WA)	WA
Hardwood - Seasoned	AS2796	Structural No.2	-	All States
	AS2082	Structural No.2	AHQC	All States
			FPA (WA)	WA
Softwood - Seasoned	AS2858	Structural No.2	Pine Div QTB	Qld and NSW
Radiata pine - Seasoned	AS2858	Structural No.2	RPAA	All States

Timber decks provide recreation space and water access in residential development.

Timber boardwalks provide practical and economical recreation space on river frontages.

Species Selection

The traditional timber used in Australia for heavy decking is hardwood. The main reasons include hardwood's ready availability, natural durability and proven performance with minimum maintenance.

However, pressure-preservative treated and seasoned softwoods being now so commonly available, they are widely used in applications such as foot bridges, boardwalks and the like. (For more information about preservative-treated timber, refer to NTDP Technical Report No.5, *Treated Timber in Australia: CCA and the Alternatives*, available from: www.timber.org.au

Table 3 provides guidance on readily available species suitable for commercial, industrial and marine decking applications. A range of acceptable species be included to meet the needs all of a project needs, rather than attempting to just use a single species.

Reference should be made to *Datafile P1 - Timber Species and Properties* for further information on stress grades and the suitability of timber species for particular internal, external, in-ground and marine environments.

Figure 1 Typical decking board profiles

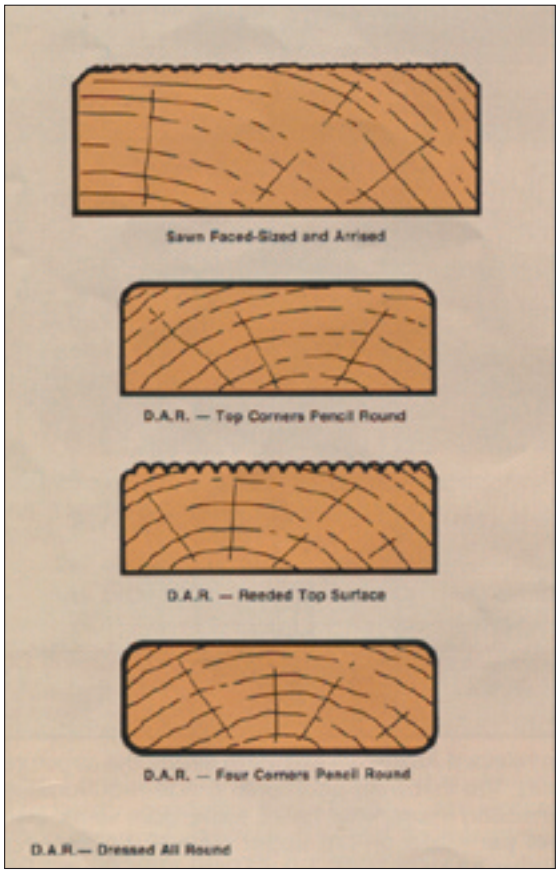


Table 2: Cross-section dimensions for Australian decking timbers.

Timber	Cross Sections (mm x mm)	Stress Grades	Availability (States)
Hardwood - Unseasoned	75 x 38 to 200 x 75	F14, F17	Qld
		F11, F14	NSW
		F11, F14	Tas Vic WA SA
Hardwood - Seasoned	70 x 35/45; 90 x 35/45 120 x 35/45	F17, F22	Qld NSW
	70 x 30/40; 80 x 30/40; 110 x 30/40	F14, F17	Tas Vic WA SA
Softwood - Seasoned (including Radiata pine)	70 x 35/45; 90 x 35/45; 120 x 35/45; 140 x 70; 190 x 70	F5, F8, F11	All States

Notes to Table 2:

1. *Unseasoned hardwood sizes are nominal sizes and usually finish 5mm under the nominal dimensions.*
2. *Seasoned sizes are finished sizes.*

Table 3: Strength and durability grades, shrinkage and density for seasoned and unseasoned timber species.

Species	Strength Group	Durability	Joint Group	Tangentinal Shrinkage Green to 12%	Density @ 12% M.C.	Availbility: blank - not normally available ○ - limited availability ● - readily available						
						WA	SA	TAS	VIC	NSW	QLD	NT
Hardwoods												
balau (selangan batu)	S2	2	J1	4.5	750	○			○	○	○	○
blackbutt[5]	S2	2	J2	7.3	930					●	●	
box, brush	SD3	3	JD2	9.7	880		○		○	●	●	
box, grey	S2	1	J1	7.4	1105					○		
gum, blue Sydney	SD3	3	JD2	9.5	843					○	○	
gum, grey[5]	S1	1	J1	6	1050					○		
gum, red forest[5]	S3	1	J1	8.6	1010					○	●	
gum, river red	S5	2	J2	8.9	910		○			○		
gum, rose	SD4	3	JD2	7.5	750					○	○	
gum, spotted	S2	2	J2	6.1	1010		○			●	●	
ironbark, grey[3]	S1	1	J1	7.5	1105					○	○	
ironbark, red[3]	S2	1	J1	6.3	1090				○	○	○	
jarrah	S4	2	J2	7.4	820	●	○	○	●	○		●
kapur	S3	2	J2	6	750	○	○				○	○
kwilla (merbau)[5]	S2	2	J2	2.5	850	○	○		●	○	●	○
mahogany, red[5]	S2	2	J1	6.3	955					○		
mahogany,[5] Southern	S2	2	J2	9.8	919					○		
mahogany, white[5]	S2	2	J1	5.4	956					○	○	
messmate[5]	S2	3	J3	11.3	769					○		
messmate,[5] gympie	S2	1	J1	6.1	1010						○	
satinay[3]	SD3	2	JD2	10	800					○	●	
stringybark,[5] white	S3	2	J2	10.6	836					○	○	
stringybark,[5] yellow	S3	2	J2	7.5	884				○	○	○	
tallowwood[5]	S2	1	J1	6.1	1010				○	○	●	
turpentine[3]	SD3	1	J2	13	945				○	○	●	
Softwoods												
pine, Carribean	SD6	4	J4	3.6	575					○	●	
pine, hoop	SD5	4	J4	3.8	575					○	●	
pine, radiata	SD6	4	J4	5.1	540	●	●	●	●	●	●	○
pine, slash	SD5	4	J4	4.8	625					●	●	
cedar, western red	SD8	2	J5	3	380	○	○	○		○	●	

(Notes regarding Table 3:

1. *Durability Class 3 species are only suitable for exposed decking applications if extra preservative maintenance is applied to the end-grain and joints.*
2. *Brush box, satinay, turpentine, Sydney blue gum, rose gum and all pines should be seasoned before fixing.*
3. *Species marked [3] are suitable for use below high-water in a marine environment.)*

Heavy hardwood decking makes for practical and hard-wearing jetties.

Expo 88 boardwalk under construction using hardwood substructure and 45 mm thick hardwood decking.

CCA treated softwood decking in exposed beachfront environment.

Heart-in Timber

Hardwood bearers over 175 x 175mm in cross-section can have heart within the central one-third of the timber sections. If the sections are exposed, it is advisable to specify members with high density, low shrinkage species and a prior history of performance with heart-in (for example red ironbark). Confirm the availability of timber from preferred hardwood species before considering them when specifying for a building project. Large members containing heart are subject to heart-shake development. Sealing the member by end-planting can reduce the longitudinal fissures that may otherwise result from this.

Preservative Treatment

The preservative treatment needed will depend on the natural durability of the species used and the decay and insect hazard which exists for each particular application.

Water-borne preservatives such as CCA, ACQ and Copper (Cu) azole are the most suitable preservatives for the treatment of timber decking. These types of preservatives should be applied to non-durable timber species that will be in direct ground contact. Light organic solvent preservatives (LOSPs) should never be used for the ground contact timbers of a deck. Heavy-duty preservatives like creosote and PEC are best suited to industrial applications rather than domestic decks.

All exposed naturally non-durable timbers will benefit from regular maintenance applications of brush-on finishes, even though the timber was preservative treated before use.

Finishes such as paints and varnishes enhance the timber's colour and improve its weather-resistance. For more details on natural durability and preservative treatment, refer to *Datafile P4 - Timber – Design for Durability*.

Moisture Content and Shrinkage

External decking timbers exposed to the weather will reach Equilibrium Moisture Content (EMC) with their surrounding after 9-18 months depending on prevailing weather, size and timber used.

For coastal Australia, decks that are well ventilated should reach an EMC of between 16% and 18%. For decks close to and over water, EMC's will normally be a little higher (18-21%) and for dry inland areas the EMC will be somewhat lower (10-12%).

The rate of shrinkage occurring in unseasoned timber will vary depending on the climate and location.

Allowance should therefore be made for shrinkage in bearers, joist and decking and for the gaps that will occur between the decking boards. About 6% shrinkage (6mm/100mm width of board) should be expected for unseasoned hardwood. An indication of the amount of shrinkage from green to 12% moisture content for various hardwood and softwood species, is given in Table 3 (page 5). As an example, if unseasoned spotted gum decking (150 x 50mm) was butted together on installation, the final gap between the boards (after say, 9 months) would be of the order of 6% of 150mm (which is 9mm).

Seasoned decking should be installed with the required gap between deck boards as they are being laid. Closing of these gaps may take place during prolonged wet periods, and gaps not less than 6mm should be provided.

Design

AS1170.1-1989 – *Dead and Live Loads and Load Combinations*, provides guidance on the live loads (point and uniformly distributed loads) required for most commercial and industrial applications. For road bridges, reference should be made to the relevant design rules available through local government and state rail authorities. In general, minimum uniformly distributed loads for commercial/industrial applications are of the order of 4.0 kPa with point loads varying from 4.5 kPa up to 31 kN. For decking, point loads will usually govern the design.

Bearers and Joists

Tables 4 (page 7) and Table 5 (page 8) provide bearer and floor joists span tables for a uniformly distributed live load (UDLL) of 5.0 kPa. Tables for 2.0 kPa to 4.0 kPa UDLL are published by CSIRO in: *Low Rise Domestic and Similar Framed Structures – Part 5 – Supplementary Design Tables*.

It should be noted that tables 4 and 5 do not account for heavy point loads and therefore member stresses should be checked for loads in excess of 10 kN. AS1720, *Timber Structures* provides rules for member stress loads including load sharing and distribution factors for parallel and grid support systems.

Table 4: Bearers – 5.0 Kpa Live Load for Deflection = Span/360

Bearer Spacing	Size (mm x mm)	Single Span (m)					Continuous Span (m)				
		F5	F8	F11	F14	F17	F5	F8	F11	F14	F17
Unseasoned timber											
2400mm	200x75	1.4	1.9	2	2.2	2.2	1.4	2	2.3	2.6	2.9
	200x75	1.8	2.5	2.6	2.7	2.8	1.8	2.5	2.9	3.2	3.6
	300x75	2.2	2.9	3.1	3.3	3.4	2.2	3	3.4	3.9	4.3
	250x100	2.4	2.7	2.8	3	3.1	2.4	2.9	3.3	3.8	4
	300x100	2.8	3.3	3.4	3.6	3.8	2.8	3.5	4	4.5	4.9
	2/200x75	2.2	2.5	2.6	2.7	2.8	2.3	2.9	3.2	3.5	3.6
	2/250x75	2.8	3.1	3.2	3.4	3.6	2.9	3.6	4	4.4	4.7
	2/300x75	3.4	3.7	3.9	4.1	4.3	3.4	4.3	4.9	5.3	5.6
	300x175	3.6	3.9	4.1	4.4	4.6	3.8	4.7	5.3	5.7	6
	350x175	4.2	4.6	4.8	5.1	5.3	4.4	5.5	6.2	6.6	6.9
	400x175	4.8	5.3	5.5	5.9	6.1	5	6.3	7.1	7.7	7.9
3600mm	200x75	1	1.4	1.7	1.9	2	1	1.4	1.7	1.9	2.3
	200x75	1.2	1.7	2	2.4	2.5	1.2	4.7	2	2.4	2.8
	300x75	1.4	2	2.5	2.9	3	1.5	2	2.5	2.9	3.4
	250x100	1.6	2.3	2.5	2.6	2.7	1.6	2.3	2.7	3.3	3.5
	300x100	2	2.7	3	3.2	3.3	2	2.7	3.3	4	4.3
	2/200x75	1.9	2.2	2.3	2.4	2.5	1.9	2.3	2.6	3.1	3.2
	2/250x75	2.3	2.7	2.8	3	3.1	2.3	2.9	3.3	3.9	4
	2/300x75	2.8	3.3	3.4	3.6	3.8	2.8	3.5	4	4.7	4.9
	300x175	3.1	3.4	3.6	3.8	4	3.1	3.8	4.3	4.9	5.2
	350x175	3.6	4	4.2	4.5	4.7	3.6	4.5	5.1	5.8	6.1
	400x175	4.1	4.6	4.8	5.1	5.3	4.1	5.1	5.8	6.6	6.9
4800	200x75	0.7	1	1.2	1.4	1.6	0.7	1	1.2	1.4	1.6
	200x75	0.9	1.3	1.5	1.8	2.1	0.9	1.3	1.5	4.8	2.1
	300x75	1.1	1.5	1.9	2.2	2.6	1.1	1.5	1.9	2.2	2.6
	250x100	1.2	1.7	2.1	2.4	2.5	1.2	1.7	2.1	2.5	2.8
	300x100	1.5	2	2.5	2.9	3	1.5	2	2.5	3	3.4
	2/200x75	1.5	2	2	2.2	2.2	1.5	2	2.3	2.6	2.8
	2/250x75	1.8	2.5	2.6	2.7	2.8	1.8	2.5	2.9	3.3	3.6
	2/300x75	2.2	3	3.1	3.3	3.4	2.2	3	3.4	3.9	4.3
	300x175	2.6	3.1	3.3	3.5	3.6	2.6	3.3	3.7	4.3	4.7
	350x175	3	3.7	3.8	4.1	3.1	3	3.9	4.4	5	5.5
	400x175	3.5	4.2	4.4	4.7	4.8	3.5	4.5	5	5.7	6.2
Seasoned timber											
2400	190x70	1.2	1.6	1.7	-	-	1.2	1.7	2	-	-
	240x70	1.6	2.2	2.3	-	-	1.6	2.2	2.6	-	-
	290x70	2	2.6	2.8	-	-	2	2.7	3.1	-	-
	2/190x70	1.9	2.2	2.3	-	-	2	2.5	2.8	-	-
	2/240x70	2.5	2.8	2.9	-	-	2.6	3.2	3.7	-	-
	2/290x70	3.1	3.4	3.6	-	-	3.1	3.9	4.5	-	-
3600	190x70	0.9	1.2	1.5	-	-	0.9	1.2	1.5	-	-
	240x70	1.1	1.5	1.8	-	-	1.1	1.5	1.8	-	-
	290x70	1.3	1.8	2.3	-	-	1.4	1.8	2.3	-	-
	2/190x70	1.6	1.9	2	-	-	4.6	2	2.3	-	-
	2/240x70	2.1	2.4	2.5	-	-	2.1	2.6	2.9	-	-
	2/290x70	2.6	3	3.1	-	-	2.6	3.2	3.6	-	-

(**Table 4** is continued on page 8)

Bearer Spacing	Size (mm x mm)	F5	F8	F11	F14	F17	F5	F8	F11	F14	F17
4800	190x70	0.6	0.9	1	-	-	0.6	0.9	1	-	-
	240x70	0.8	1.2	1.3	-	-	0.8	1.2	1.3	-	-
	290x70	1	1.4	1.7	-	-	1	1.4	1.7	-	-
	2/190x70	1.3	1.7	1.8	-	-	1.3	1.7	2	-	-
	2/240x70	1.6	2.2	2.3	-	-	1.6	2.2	2.6	-	-
	2/290x70	2	2.7	2.8	-	-	2	2.7	3.1	-	-

Table 5: Floor Joists – 5.0 kPa Live Load for Deflection = Span/360

Bearer Spacing(mm)	Size (mm)	Single span (m)					Continuous Span (m)				
		F5	F8	F11	F14	F17	F5	F8	F11	F14	F17
Unseasoned Timber											
450	125x50	1.7	1.8	1.8	1.9	2.0	1.7	1.9	2.0	2.1	2.2
	150x50	1.8	2.1	2.2	2.3	2.4	2.0	2.3	2.4	2.6	2.7
	175x50	2.2	2.4	2.6	2.8	2.9	2.5	2.8	2.9	3.1	3.2
	200x50	2.6	2.8	3.0	3.2	3.3	2.9	3.2	3.3	3.5	3.6
	225x50	2.9	3.3	3.4	3.6	3.7	3.3	3.5	3.7	3.8	3.9
	250x50	3.3	3.6	3.7	3.8	3.9	3.6	3.8	4.0	4.1	4.3
	275x50	3.6	3.8	3.9	4.0	4.1	3.8	4.1	4.3	4.5	4.6
	300x50	3.8	4.0	4.1	4.2	4.4	4.0	4.4	4.6	4.8	4.9
	200x75	3.0	3.3	3.5	3.6	3.7	3.6	3.6	3.7	3.9	4.0
	250x75	3.6	3.9	4.0	4.1	4.2	4.2	4.3	4.4	4.6	4.8
	300x75	4.1	4.3	4.5	4.7	4.9	4.6	4.9	5.2	5.4	5.6
600	125x50	1.5	1.7	1.7	1.8	1.9	1.7	1.9	2.0	2.1	2.2
	150x50	1.8	2.0	2.1	2.1	2.2	2.1	2.2	2.4	2.5	2.6
	175x50	2.1	2.3	2.4	2.6	2.7	2.4	2.6	2.8	2.9	3.1
	200x50	2.4	2.7	2.9	3.0	3.1	2.8	3.0	3.2	3.4	3.5
	225x50	2.8	3.0	3.2	3.3	3.4	3.2	3.4	3.5	3.7	3.8
	250x50	3.1	3.3	3.4	3.6	3.7	3.4	3.7	3.8	3.9	4.0
	275x50	3.3	3.6	3.7	3.8	3.9	3.7	4.9	4.0	4.2	4.3
	300x50	3.6	3.8	3.9	4.0	4.2	3.9	4.2	4.3	4.5	4.7
	200x75	2.8	3.1	3.2	3.4	3.5	3.2	3.5	3.6	3.8	3.8
	250x75	3.4	3.7	3.8	3.9	4.0	3.8	4.1	4.2	4.3	4.5
	300x75	3.9	4.2	4.3	4.6	4.7	4.3	4.6	4.9	5.2	5.5
Seasoned Timber											
450	120x45	1.5	1.6	1.7	1.8	2.0	1.5	1.7	1.8	2.1	2.2
	140x45	1.5	1.7	1.8	2.2	2.3	1.7	1.9	2.0	2.4	2.6
	190x45	2.2	2.4	2.6	3.0	3.2	2.5	2.7	2.8	2.3	3.5
	240x45	2.9	3.2	3.3	3.7	3.8	3.2	3.3	3.5	4.0	4.1
	290x45	3.4	3.6	3.7	4.1	4.3	3.6	3.9	4.1	4.6	4.8
	190x70	2.9	3.2	3.4	3.5	3.6	3.2	3.5	3.6	3.7	3.9
	240x70	3.2	3.5	3.6	4.0	4.2	3.7	3.8	3.9	4.5	3.6
	290x70	3.7	3.9	4.1	4.6	4.8	4.2	4.4	4.7	5.2	5.5
600	120x45	1.4	1.5	1.6	1.7	1.9	1.5	1.7	1.8	2.0	2.2
	140x45	1.5	1.7	1.7	2.1	2.2	1.7	1.8	2.0	2.4	2.5
	190x45	2.1	2.3	2.5	2.8	3.0	2.4	2.6	2.7	3.2	3.3
	240x45	2.7	2.9	3.0	3.5	3.6	3.0	3.3	3.3	3.7	3.8
	290x45	3.2	3.4	3.5	3.9	4.1	3.5	3.7	3.8	4.3	4.5
	190x70	2.7	3.0	3.1	3.2	3.2	3.1	3.4	3.5	3.6	3.8
	240x70	3.0	3.3	3.4	3.8	4.0	3.4	3.6	3.7	4.2	4.4
	290x70	3.5	3.8	3.9	4.4	4.6	3.9	4.2	4.4	5.0	5.2

NOTE: Double bearers should be effectively fixed together at the third points within each span. Bearers may be spaced using blocking pieces. Refer to Figure 2.

Heavy-duty suspended vehicular access.

Metal capping provides protection to end-grain of bollard.

Decking Boards

Table 6 gives the allowable spans for various grades and sizes of timber decking. Generally, the closer the joist spacing, the better restrained are the decking boards and the less likely they are to distort during service. Table 2 matches the correct stress grade(s) to use for given cross-section dimensions, taking into account whether the decking board is seasoned or unseasoned, hardwood or softwood. It also lists what stress grades are available in each state of Australia.

Decking Boards

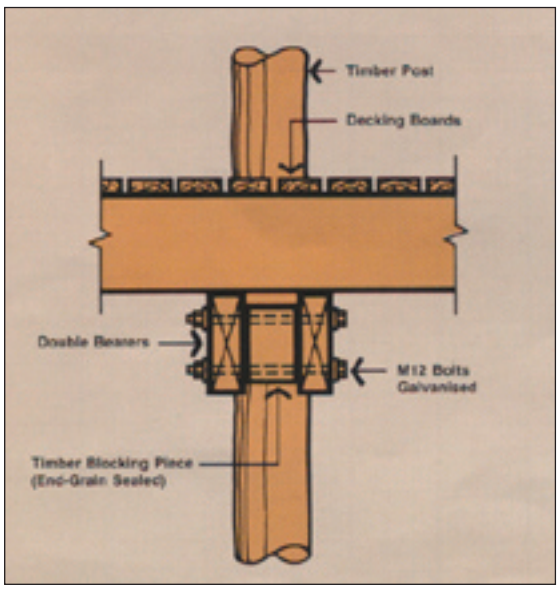
Table 6 gives the allowable spans for various grades and sizes of timber decking. Generally, the closer the joist spacing, the better restrained are the decking boards and the less likely they are to distort during service. Figure 2 (below) illustrates how the load requirements for a commercial timber decking application can be met by using a typical double-bearer construction.

Construction

On-Site Storage

Prior to construction, delivered timber should be stored on dry ground, supported on level bearers 150mm high. Timber should be left block stacked and banded until required. Both seasoned and unseasoned decking boards should be covered to protect them from sun and rain.

Figure 2: Typical double bearer construction



End-Plating and Sealing

Unseasoned timber loses moisture quickly from the end-grain. To reduce end-splitting in unseasoned timber, the end-grain should be coated immediately after sawing with a suitable sealer such as petroleum jelly or Mobile-M wax emulsion. In addition, all unseasoned sections with dimensions of 300 x 75mm or greater, should be end-plated with a multi-toothed plate connector covering at least 50% of the exposed end section. Timber should be supplied to each site with the end-sealing and plating already in place.

Fasteners

All fixing (nails, bolts, screws, plates, etc.) should be either stainless steel monel metal or hot-dipped galvanised or mechanically plated (ie: Galvacoat or Aquametal) to comply with AS1650. Table 7 (page 11) provides relevant fastener details for the fixing of the decks.

All bolts in bearers to joist and bearer support connections should be hot-dipped galvanised and conform with AS1111. All nuts should be turned snug tight as defined by AS1511. Joints should be checked and re-tightened after 6 months. Where CCA treated timber has been used and moisture is continually present, hot-dipped galvanised bolts and other fasteners should be coated with heavy-bodied grease prior to installation.

On large unseasoned members where re-tightening is not possible, a volute coiled stainless steel spring washer should be used to maintain a tight fit as the timber shrinks due to moisture loss.

Pre-drillling

Bolt holes in unseasoned timber should be drilled to the bolt diameter + 10%, and in addition, where multiple bolts or fasteners are used in unseasoned timber, allowance for shrinkage restraint should be made. Shrinkage restraint will occur where multiple connectors

Boardwalk substructure provides fixing base for metal handrails.

Table 6: Allowable Decking Board Spans (Continuous Support)

Size W x T (mm x mm) Finished or Sized Dimensions	Allowable Spans (mm) For Point Loads of:											
	4.5 kN (Light Pedestrian Traffic)			9.5 kN (Heavy Pedestrian Traffic)			13Kn (Light Vehicular Traffic)			31 kN (Heavy Vehicular Traffic)		
Hardwood - unseasoned												
	F11	**F14**	**F17**	**F11**	**F14**	**F17**	**F11**	**F14**	**F17**	**F11**	**F14**	**F17**
70x35	318	400	491	-	-	-	-	-	-	-	-	-
95x35	431	550	667	-	-	333	-	-	-	-	-	-
70x45	525	660	812	-	-	406	-	-	-	-	-	-
95x45	713	980	997	356	490	551	-		381	-	-	-
120x45	901	1060	1122	450	620	696	311	430	481	-	-	-
145x45	10068	1200	1227	544	750	842	376	520	582	-	-	-
170x70	1829	1850	2013	1544	1660	1832	1068	1220	1651	448	510	692
195x70	1915	2050	2107	1699	1930	1962	1226	1640	1894	514	690	794
Hardwood - seasoned												
	F17	**F22**		**F17**	**F22**		**F17**	**F22**		**F17**	**F22**	
70x35	446	577		-	-		-	-		-	-	
95x35	573	713		-	370		-	-		-	-	
120x35	765	598		382	300		-	-		-	-	
70x45	738	916		369	477		-	330		-	-	
90x45	949	1039		474	613		330	425		-	-	
120x45	1122	1199		632	818		437	565		-	-	
Hardwood - seasoned (alternative sizes)												
	F14	**F17**		**F14**	**F17**		**F14**	**F17**		**F14**	**F17**	
70x30	-	327		-	-		-	-		-	-	
85x30	327	397		-	-		-	-		-	-	
110x30	424	515		-	-		-	-		-	-	
70x40	480	582		-	-		-	-		-	-	
85x40	583	708			354		-	-		-	-	
110x40	754	901		377	457		-	316		-	-	
Softwood - seasoned												
	F5	**F8**	**F11**	**F5**	**F8**	**F11**	**F5**	**F8**	**F11**	**F5**	**F8**	**F11**
70x35	-	-	-	-	-	-	-	-	-	-	-	-
90x35	-	-	370	-	-	-	-	-	-	-	-	-
120x35	-	386	493	-	-	-	-	-	-	-	-	-
70x45	-	371	474	-	-	-	-	-	-	-	-	-
90x45	306	478	611	-	-	-	-	-	-	-	-	-
120x45	409	639	817	-	319	408	-	-	339	-	-	-
140x70	1150	1744	1829	576	901	1152	398	623	797	-	-	334
190x70	1565	1810	1890	782	1223	1564	451	846	1083	-	355	454

NOTES:

1. *These sizes are also capable of carrying uniformly distributed loads of at least 5 kPa.*
2. *The sizes/spans satisfy a short duration point load deflection limit of span/180.*
3. *This table is intended as a guide only and does not negate the need for specific engineering designs.*

Table 7: Deck Fixing

Decking Thickness (mm)	Nails	Corrosion Protection	Screws	Corrosion Protection
30 - 35	100 x 3.4 Gun Nail Flat Head	Hot Dipped galvanised	75 x No. 14 Type 17 Batten Screw	Hot Dipped Galvanised
	100 x 3.75 Flat Head (Pre-drilling may be required)	Hot Dipped Galvanised	75 x No. 14 Type 17 Hex-Head Roof Screw (Required countersink for Head)	Stainless Steel or hot Dipped Galvanised
40-45	125 x 5.6 Dome Head Decking Spike (Pre-drilling Required)	Hot Dipped Galvanised	90/100 x No. 14 Type 17 Batten Screw	Hot Dipped Galvanised
			90/100 x No.14 Type 17 Hex-Head Roof Screw (Requires countersink for Head)	Stainless Steel or hot Dipped Galvanised
70	200 x 9.0 Decking Spike	Hot Dipped Galvanised	-	-

are used with steel or where timber members cross.

Pre-drilling for screws or nails may be necessary to avoid splitting. In all cases, trial fastening should be undertaken to determine tendency to split. Where pre-drilling for screws or nails is required, the pre-drilled hole should be approximately 80% of the shank diameter of the screw or nail.

The size of fastener required to fix the decking boards may dictate the minimum floor joist thickness. Table 8 provides guidance in this regard.

Joint Detailing

The durability of the joints is a key factor in determining the durability of the entire structure. When designing joints in timber decks, the following general guidelines should be adhered to:

- Keep the contact area between members in a joint to a minimum.
- If possible, make all joints self-draining
- Where the contact area is excessive or durability in the joint may be a problem, use a preservative paste (e.g., Koppers CN Emulsion, Protim Solignum Reseal) or a bitumastic type sealer on the contact surfaces.
- Consider the likely changes to the joint as the members season and avoid bolt or nail configurations which are likely to cause splitting as the timber seasons.
- The end-grain of each timber member should be sealed with a suitable water repellent sealer (e.g. Mobilcer-M Wax Emulsion).
- Where possible, ensure the joint receives as much natural ventilation as possible.

Workmanship

The correct installation of the deck will ensure it performs its purpose throughout its predicted service life. A number of particular aspects concerning workmanship should be considered.

Nailing

A trial panel of decking should be prepared to assess the potential splitting problems of undrilled nails, spikes, or screws. If splitting is a problem, then pre-drilling may be needed. Pre-drilled holes should be approximately 80% of the diameter of the nail. Pre-drilling should be carried out for the full length of the nail. To minimise splitting of joists, alternate nails should be offset on each side of the centreline of the underlying joist. Alternate nails should also be driven at slightly opposing angles. Nails should be driven flush against the timber surface level, as indicated in Figure 3.

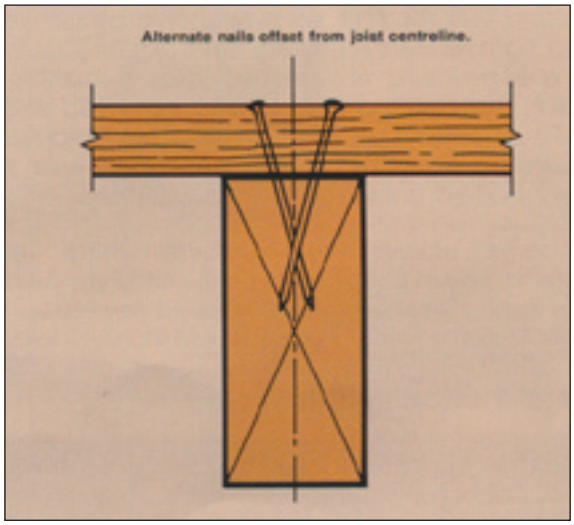
Bolting

Bolt holes should be drilled approximately 10% larger than the bolt diameter. Holes should be drilled straight and bolts should not be bent or excessively forced into holes.

Table 8: Fastener Size – Joist Width

Nail Size (dia. mm.)	Screw Size (dia. mm.)	Minimum Floor Joist Width (mm)
Up to 3.75	-	50
4.5 to 5.6	Up to 6	75
9 (deck spikes)	-	100

Figure 3: Deck Nailing



Decking panels fixed over concrete with stainless steel locating bolts – decking boards screw to battens from underside.

Sealing

All cut ends should be sealed with Mobilcer-M Wax Emulsion or similar sealant as soon as possible after the timber components are cut. All ends should be cut square.

Fitting

When decking boards are butted lengthwise, the fit should be tight with no gap. A slight back-cut will assist in ensuring a tight fit for butt joints. Where boards are fitted side by side, any variation in gap width between boards should be eliminated. The finished gap width after seasoning should be between 6mm and 10mm. For seasoned decking a gap of 6mm is recommended. In unseasoned timber, mitre cuts should be made with an internal angle of 47 degrees to allow for uneven shrinkage across the cut. This allowance will result in parallel gaps at the mitre, after shrinkage.

Off-Cuts

Off-cuts, sawdust, disused metal and fasteners should be removed from the deck area as soon as possible after cutting as these will stain underlying boards.

Handling

Timber that is damaged because of poor handling or storage should be re-graded.

Fibreglass overlayed plywood decking in marina walkway.

A treated-timber patio deck is an economical and practical way to gain extra living space while simultaneously enhancing the home landscape.

Ventilation

The long- term satisfactory performance of decking and timber sub-structures can be markedly enhanced by ensuring that there is adequate ventilation around the timber components and joints. Where decks are placed over damp/wet ground or over water, care should be taken to avoid dead air pockets. The wider the spacing between decking board, the greater the ventilation and the longer the deck will last. As a minimum, a final decking board spacing of 6mm is suggested.

Finishing and Maintenance

Finishing

A number of easily maintained finishes are available and should be considered in respect of each particular project.

An appropriate finish in most cases would be an oil based stain used in conjunction with a water repellent product. For industrial and marine applications the addition of coatings decking finish will promote improved long term performance. For some commercial applications, the use of finishes may be appropriate to provide colour or alternatively, protection against staining where food and drinks are served. But never use preservative-treated timber for food and drink surfaces. For further details on finishing timber elements, refer to *Datafile FM1 - Exterior Finishes For Timber*.

Maintenance

Most heavy deck structures are generally designed to have little or no maintenance. The areas where maintenance may be required are as follows:

- Replacement of damaged decking boards.
- If a stain finish is used, re-finishing will be needed at intervals, depending on the period of time, type of exposure and volume of traffic.
- The end sealants may deteriorate our over time on exposed ends and further applications may be required to prevent splitting.
- Loose boards may develop as a result of excessive vibration loading and these should be re-fixed.
- The tightening of bolts after the larger members have stabilised to Equilibrium Moisture Content (EMC) may also be necessary.
- The re-punching of some nails may be necessary after allowing a reasonable period of shrinkage of various members.

Plywood Decking Panels

Especially developed, engineered plywood products are also available for decking applications. These include:

- Preservative-treated plywood panels up to 150mm thick, and
- Preservative-treated, non-slip surfaced plywood.
- Plywood manufacturers or the Plywood Association should be contacted for information on availability and design options for these products.

An Example of Deck Design

Exercise: Determine the member sizes for a boardwalk deck supporting a 13 kN point load and 5.0 kPa uniformly distributed live load, using unseasoned spotted gum. Bearers are spaced at 3.6 m and span 5.0 m.

Timber decking has many uses in the garden. Timber decking is versatile, and can be used for level, raised or sunken areas, with balustrades added for safety and visual effect.

Specification

For recommended timber species and product dimensions to meet particular design specifications, refer to Datafile SP1, *Timber Specifications*. The following is a check-list of items which should be included in the specifications for timber decks. All items are covered in detail in that particular Datafile.

1. Use Structural Grade No. 2, spotted gum – stress grade F17.
2. From Table 4, bearer size required, for single span F17 is 400 x 175mm.
3. From Table 5, joist size required, for 450 centres F17 is 225 x 50mm.
4. From Table 6, the minimum decking size required for a point load of 13 kN using unseasoned F17 hardwood is 120 x 45mm.
5. Framing Timbers
   - Species
   - Sizes
   - Stress grade/branding
   - Seasoned/unseasoned
   - End-sealing
   - End-plating
   - Natural durability or preservative treatment
6. Decking Boards
   - Species
   - Size/profile
   - Grade and branding
   - Seasoned or unseasoned
   - End-sealing
7. Workmanship
8. Fixings (Framing)
   - Fastener type, size and number
   - hot-dipped, galvanised finish
   - edge distances
9. Fixings (Decking)
   - Fastener type, size and number
   - board spacing
10. Finishing
    - if suitable
11. Maintenance
    - tightening of connections at completion of project
    - inspection and re-application of finishes at regular intervals

Observation decks and walkways in coastal recreational area, providing access but protects the natural environment.

Other References

1. AS1720.1 – *Timber Structures*, Standards Australia
2. *Commercial Hardwood Decking*, Technical Data Sheet 7, Timber Research and Development Advisory Council of Queensland
3. AS2082, - *Timber – Hardwood – Visually Stress Graded for Structural Purposes*, Standards Australia
4. AS2858, - *Timber – Softwood – Visually Stress Graded for Structural Puroposes*, Standards Australia
5. *Timber Bridges*, Department of Main Roads, Qld –A.j. Platz 1988.

For further information contact these timber organisations:

NATIONAL

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Australian Plantation Products and Paper Industry Council (A3P)
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